IS 4511-6 (1987): Methods of Test for Styrene-butadiene Rubber (SBR) Latices, Part 6: Determination of High-speed Mechanical Stability [PCD 13: Rubber and Rubber Products]

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Indian Standard

METHODS OF TEST FOR STYRENE-BUTADIENE RUBBER (SBR) LATICES

PART 6 DETERMINATION OF HIGH-SPEED MECHANICAL STABILITY

[SBRL : 11]

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Indian Standard

METHODS OF TEST FOR STYRENE-BUTADIENE RUBBER (SBR) LATICES

PART 6 DETERMINATION OF HIGH-SPEED MECHANICAL STABILITY

[SBRL : 11]

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Indian Standard

METHODS OF TEST FOR STYRENE-BUTADIENE RUBBER (SBR) LATICES

PART 6 DETERMINATION OF HIGH-SPEED MECHANICAL STABILITY

[SBRL : 11]

0. FOREWORD

0.1 This Indian Standard (Part 6) was adopted by the Indian Standards Institution on 27 February 1987, after the draft finalized by the Rubber Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 Test methods for rubber latex had been originally covered in the following Indian Standards:

For natural rubber latex

IS : 3708 (Part 1)-1966*

IS : 3708 (Part 2)-1968†

For styrene butadiene rubber latex

IS : 4511 (Part 1)-1967‡

Since some of the test methods covered in above standards were common, the concerned committee had decided some years ago to unify and publish a separate series of methods of test which would be applicable to all types of latices — natural as well as synthetic. Accordingly, the following six test methods had been covered under IS : 9316:

IS : 9316 Methods of test for rubber latex:

Part 1-1979 Determination of surface tension

Part 2-1979 Determination of viscosity

*Methods of test for natural rubber latex: Part 1 Dry rubber content, sludge content, density, total alkalinity, KOH-number, mechanical stability, volatile fatty acid number, *p*H, total nitrogen, total copper, total iron, total manganese and total ash.

†Methods of test for natural rubber latex, Part 2.

‡Methods of tests for styrene-butadiene rubber (SBR) latices: Part 1 Determination of dry polymer, *p*H, density, residual styrene, bound styrene and soap content.

Part 3-1979 Determination of coagulum content
Part 4-1979 Determination of total solids content
Part 5-1979 Drawing of samples
Part 6-1982 Determination of *p*H

0.2.1 As a result of further rethinking on the subject, it has now been decided to re-designate the test methods common to natural and synthetic rubber latices as RL series; test methods for natural rubber latex as NRL series and test methods for styrene-butadiene rubber latex as SBRL series. Consequently, test methods for rubber latex have been rationalized into the following three series:

a) IS : 9316 Unified methods of test applicable to both natural and synthetic rubber latices — RL series;

b) IS : 3708 Methods of test applicable to natural rubber latex — NRL series; and

c) IS : 4511 Methods of test applicable to styrene-butadiene rubber latex — SBRL series.

0.3 The existing Indian Standards under IS : 3708 (Parts 1* and 2†), IS : 4511 (Part 1‡) and IS : 9316 (Parts 1 to 6) are being gradually replaced by separate standards under the above three series, designated by the appropriate NRL, SBRL, or RL series, respectively.

0.3.1 The methods covered under NRL : 13, NRL : 14 and NRL : 15 of IS : 3708 (Part 1)-1966 are now being covered under the RL series in IS : 9316 (*under revision*).

0.4 In order to facilitiate cross-reference, it has been decided to retain the original discrete SBRL series numbers assigned to various test methods in IS : 4511 (Part 1)-1967‡ in the revised Parts of IS : 4511. The test method as prescribed in this standard has been newly taken up under SBRL series.

0.4.1 For proper referencing of the existing test methods and the new methods under revision, a statement showing corresponding methods is given in Appendix A.

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*Methods of test for natural rubber latex: Part 1 Dry rubber content, sludge content, density, total alkalinity, KOH-number, mechanical stability, volatile fatty acid number, *p*H, total nitrogen, total copper, total iron, total manganese and total ash.

†Methods of test for natural rubber latex, Part 2.

‡Methods of tests for styrene butadiene rubber (SBR) latices: Part 1 Determination of dry polymer, *p*H, density, residual styrene, bound styrene and soap content.

0.5 In preparing the above series, the need to align the test methods with the corresponding ISO Standards/DIS/DP wherever available has also been taken into account for updating the test methods. In the preparation of this standard, assistance has been derived from ISO 2006-1985 'Rubber latex synthetic — Determination of high-speed mechanical stability' issued by International Organization for Standardization (ISO).

0.5.1 Though the method prescribed in ISO 2006-1985 is applicable to all types of synthetic rubber latex but in this standard the scope has been limited to styrene-butadiene rubber latex only under existing SBRL series, as decided by the Committee concerned.

0.6 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part 6) prescribes a method for the determination of high-speed mechanical stability of styrene-butadiene rubber latex.

2. GENERAL

2.1 The test method given below covers determination of the high-speed mechanical stability of synthetic rubber latex. The test is applicable to synthetic rubber latices which have a viscosity, determined with the *L* instrument in accordance with IS : 9316 (Part 2)-1979† of up to 200 mPa.s (200 cP). Latices of higher viscosity shall be tested after dilution to a viscosity of 200 mPa.s (200 cP) or less, provided that such dilution does not reduce the concentration of the latex by more than 10 percent total solids.

NOTE — Dilution of the latex decreases its stability because the balance of free and absorbed soap is changed.

2.2 The duration of stirring shall be so selected that the latex does not increase in temperature to more than 60°C and does not exceed a height of 100 mm in the latex container. The duration of stirring shall be as agreed to between the purchaser and the supplier and shall not be longer than 30 minute or less than 1 minute. In the case of a latex which contains ammonia, the duration of stirring shall be limited, since loss of ammonia by evaporation during the test may cause additional destabilization.

*Rules for rounding off numerical values (*revised*).

†Method of test for rubber latex: Part 2 Determination of viscosity (*first revision*).

2.3 The test does not necessarily indicate the stability of a synthetic rubber latex to high shear stress, for which a rubbing test may be more applicable.

3. OUTLINE OF THE METHOD

3.1 The amount of coagulum formed after stirring of the latex at high speed, is regarded as an inverse measure of the mechanical stability of the latex.

4. REAGENT

4.1 Soap Solution — 5 percent (*m/m*) solution of potassium oleate of *p*H value 10, or, for use with a latex which is coagulated by potassium oleate solution, 5 percent (*m/m*) solution of a synthetic anionic or non-ionic surfactant.

4.2 Distilled Water — *See* IS : 1070-1977*.

5. APPARATUS

5.1 Mechanical Stability Measuring Apparatus — consisting of the following items.

5.1.1 *Latex Container* — Flat bottom cylindrical, at least 100 mm high, with an internal diameter of 58 ± 2 mm and a wall thickness of about 2·5 mm. The inner surface shall be smooth, and a glass container is preferred. A suitable cooling device may be provided around the latex container so that the temperature does not increase beyond the specified temperature.

5.1.2 *Stirring Apparatus* — consisting of a vertical stainless steel shaft of sufficient length to reach to the bottom of the latex container **5.1.1** and tapering to approximately 6·3 mm diameter at its lower end, where is attached a horizontal, smooth, stainless steel disc 36·12 ± 0·03 mm in diameter and 1·57 ± 0·05 mm thick by means of a threaded stud at the exact centre of the disc. The apparatus shall maintain a stirring speed of 14 000 ± 200 rev/min throughout the test, at which speed the shaft shall not run out of true by more than 0·25 mm.

5.1.3 *Holder* — for the latex container **5.1.1**. The holding arrangement shall ensure that the axis of the rotating shaft is concentric with that of the latex container and that the bottom of the stirring disc is 13 ± 1 mm from the inner surface of the bottom of the latex container.

5.2 Preliminary Filter — of stainless steel wire cloth with an average aperture width of 180 ± 15 μm.

*Specification for water for general laboratory use (*second revision*).

5.3 Test Filter — consisting of a disc of stainless steel wire cloth with an average aperture width of 180 ± 15 μm, dried to constant mass and weighed to the nearest 1 mg, firmly clamped between two stainless steel rings of equal internal diameter between 25 and 50 mm.

6. PROCEDURE

6.1 In case viscosity of the latex determined with the *L* instrument [according to IS : 9316 (Part 2)-1979*] exceeds 200 mPa.s (200 cP), dilute it to this or a lower value, with an amount of water which reduces the concentration of the latex by not more than 10 percent (*m/m*) total solids.

6.2 Adjust the temperature of the latex to 25 ± 3°C, pass it through the preliminary filter (**5.2**) and transfer 50 ± 0·5 g to the latex container. Place the container (**5.1.1**) in position and stir the latex at 14 000 ± 200 rev/min for 30 minutes, such that the latex does not increase in temperature to more than 60°C and does not exceed a height of 100 mm in the container. If it is necessary to limit foaming, a paste of a silicone defoamer shall be smeared around the upper portion of the inner surface of the container. Immediately after the termination of stirring, remove the latex container and wash the stirrer shaft and disc free from latex deposits with soap solution.

Wet the test filter (**5.3**) with soap solution and pour the latex and washings into the test filter. Use soap solution to ensure quantitative transfer of all latex and deposits including skin. Wash the residue on the test filter with soap solution until it is free from latex and then with water until the washings are neutral to litmus. Carefully remove the test filter containing the wet solid matter and swab the underside with filter paper. Dry the test filter and coagulum at 105 ± 2°C until the change in mass is less than 1 mg after 15 minute drying.

7. EXPRESSION OF RESULTS

7.1 The high-speed mechanical stability of the latex shall be reported as the percentage of coagulum which is formed. Calculate it as a percentage by mass of the latex, using the formula:

$$\text{Coagulum, percent by mass} = \frac{M_1 \times 100}{50}$$

where

M_1 = mass, in g, of coagulum.

*Method of test for rubber latex: Part 2 Determination of viscosity (*first revision*).

APPENDIX A

(*Clause* 0.4.1)

TABLE SHOWING CORRESPONDENCE OF THE VARIOUS METHODS OF TEST COVERED IN THE EXISTING IS : 9316 (PARTS 1 TO 5)-1979, IS : 9316 (PART 6)-1982, IS : 3708 (PART 1)-1966, IS : 3708 (PART 2)-1968, IS : 4511 (PART 1)-1967 *WITH* THE REVISION/PROPOSED REVISION OF IS : 9316, IS : 3708 AND IS : 4511

Existing Test Methods			Proposed Revisions		Remarks
Test Method	IS No.	Part (Series)	IS No.	Series	
(1)	(2)	(3)	(4)	(5)	(6)
RL SERIES					
Determination of surface tension	IS : 9316-1979	Part 1	IS : 9316	Part 1 (RL:1)	
Determination of viscosity	IS : 9316-1979	Part 2	IS : 9316	Part 2 (RL:2)	
Determination of coagulum content	IS : 9316-1979	Part 3	IS : 9316	Part 3 (RL:3)	
Determination of total solids content	IS : 9316-1979	Part 4	IS : 9316	Part 4 (RL:4)	Under revision
Drawing of samples	IS : 9316-1979	Part 5	IS : 9316	Part 5 (RL:5)	Under revision
Determination of *p*H	IS : 9316-1982	Part 6	IS : 9316	Part 6 (RL:6)	Under revision
Determination of total copper	IS : 3708-1966	Part 1 (NRL:13)	IS : 9316	Part 7 (RL: 7)	
Determination of total iron	IS : 3708-1966	Part 1 (NRL:14)	IS : 9316	Part 8 (RL:8)	
Determination of total manganese	IS : 3708-1966	Part 1 (NRL:15)	IS : 9316	Part 9 (RL:9)	

NRL SERIES

Determination of dry rubber content	IS : 3708-1966	Part 1 (NRL:1)	IS : 3708-1985	Part 1 (NRL:1)
Determination of sludge content	IS : 3708-1966	Part 1 (NRL:5)	IS : 3708-1985	Part 2 (NRL:5)
Determination of density	IS : 3708-1966	Part 1 (NRL:6)	IS : 3708-1985	Part 3 (NRL:6)
Determination of total alkalinity	IS : 3708-1966	Part 1 (NRL:7)	IS : 3708-1985	Part 4 (NRL:7)
Determination of KOH-number	IS : 3708-1966	Part 1 (NRL:8)	IS : 3708-1985	Part 5 (NRL:8)
Determination of mechanical stability	IS : 3708-1966	Part 1 (NRL:9)	IS : 3708-1985	Part 6 (NRL:9)
Determination of volatile fatty acid number	IS : 3708-1966	Part 1 (NRL:10)	IS : 3708-1986	Part 7 (NRL:10)
Determination of total nitrogen	IS : 3708-1966	Part 1 (NRL:12)	IS : 3708	Part 8 (NRL:12)
Determination of total ash	IS : 3708-1966	Part 1 (NRL:16)	IS : 3708-1986	Part 9 (NRL:16)
Determination of boric acid	IS : 3708-1968	Part 2 (NRL:17)	IS : 3708	Part 10 (NRL:17)
Determination of magnesium	IS : 3708-1968	Part 2 (NRL:18)	IS : 3708	Part 11 (NRL:18)

(*Continued*)

TABLE SHOWING CORRESPONDENCE OF THE VARIOUS METHODS OF TEST COVERED IN THE EXISTING IS : 9316 (PARTS 1 TO 5)-1979, IS : 9316 (PART 6)-1982, IS : 3708 (PART 1)-1966, IS : 3708 (PART 2)-1968, IS : 4511 (PART 1)-1967 *WITH* THE REVISION/PROPOSED REVISION OF IS : 9316, IS : 3708 AND IS : 4511 — *Contd*

	Existing Test Methods		Proposed Revisions		Remarks
Test Method	IS No.	Part (Series)	IS No.	Series	
(1)	(2)	(3)	(4)	(5)	(6)
SBRL SERIES					
Determination of dry polymer	IS : 4511-1967	Part 1 (SBRL:1)	IS : 4511-1986	Part 1 (SBRL:1)	
Determination of density	IS : 4511-1967	Part 1 (SBRL:6)	IS : 4511	Part 2 (SBRL:6)	
Determination of volatile unsaturates	IS : 4511-1967	Part 1 (SBRL:8)	IS : 4511	Part 3 (SBRL:8)	
Determination of bound styrene	IS : 4511-1967	Part 1 (SBRL:9)	IS : 4511	Part 4 (SBRL:9)	
Determination of soap content	IS : 4511-1967	Part 1 (SBRL:10)	IS : 4511	Part 5 (SBRL:10)	
Determination of high-speed mechanical stability	—	—	IS : 4511	Part 6 (SBRL:11)	

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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